



MORNINGSTAR READYRAIL BATTERY MANAGEMENT SYSTEM INTERFACE ACCESSORY

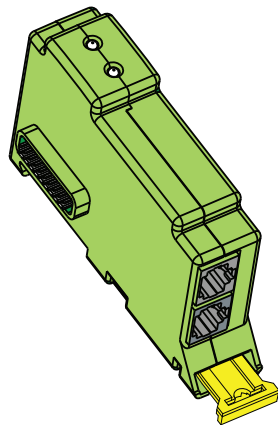
*INCLUDES: BMS Block; CAN Interface
Cable; CANBus Terminator Plug*

Installation and Operation Instructions

For the most recent manual
revisions, see the version at:
www.morningstarcorp.com

Use following URL to register Morningstar BMS Block:
<https://www.morningstarcorp.com/product-registration>

www.morningstarcorp.com



RB-BMS-1

DIMENSIONS [millimeters (inches)]

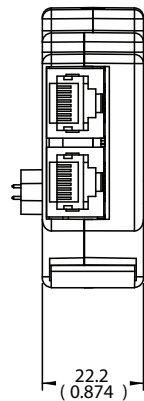
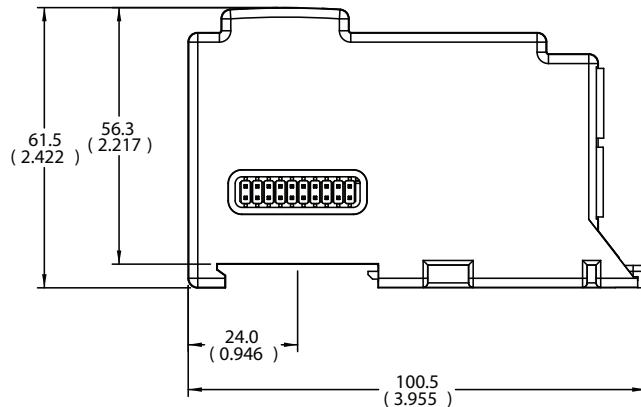
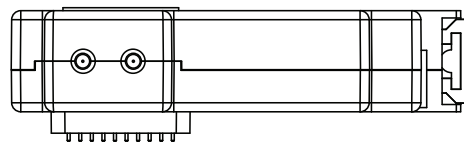


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1.0 SAFETY INFORMATION



WARNING: Shock Hazard

The Morningstar ReadyBMS must be installed by a qualified technician in accordance with the electrical regulations of the location of installation.



WARNING: Shock Hazard

Disconnect all power sources to the host and all other connected devices before installing or removing ReadyBMS. Do not install or remove ReadyBMS when the host device is powered ON.



WARNINGS: Shock Hazards

- Read all the instructions and cautions in the manual before starting the installation.
- There are no user serviceable parts in the BMS Block. Do not disassemble or attempt to repair.

2.0 GENERAL INFORMATION

2.1 Terminology

The product ReadyBMS will be referred to as such, or BMS Block. In contrast, the separate battery management system will be referred to as the BMS, battery, or BMS-battery.

2.2 Overview

The Morningstar ReadyBMS provides simple visibility of battery performance, hands-free settings and optimized battery control. The ReadyBMS will report any data variable contained by BMS-battery. ReadyBMS will support batteries in parallel depending on the capability of any approved battery model. **Use requirements:**

- The ReadyBMS requires a Morningstar ReadyRail™-enabled host device, e.g., GenStar controller or ReadyEdge Communications Center to provide a mounting surface, power, and programming capability.

- Morningstar integrated and approved battery models
- Currently updated BMS-battery firmware

2.3 Compatible Batteries (CANBus-enabled batteries)

All initially supported batteries conform to CAN pin configuration. For a current list of battery storage products supported by the ReadyBMS, go to www.morningstarcorp.com.

2.4 Features

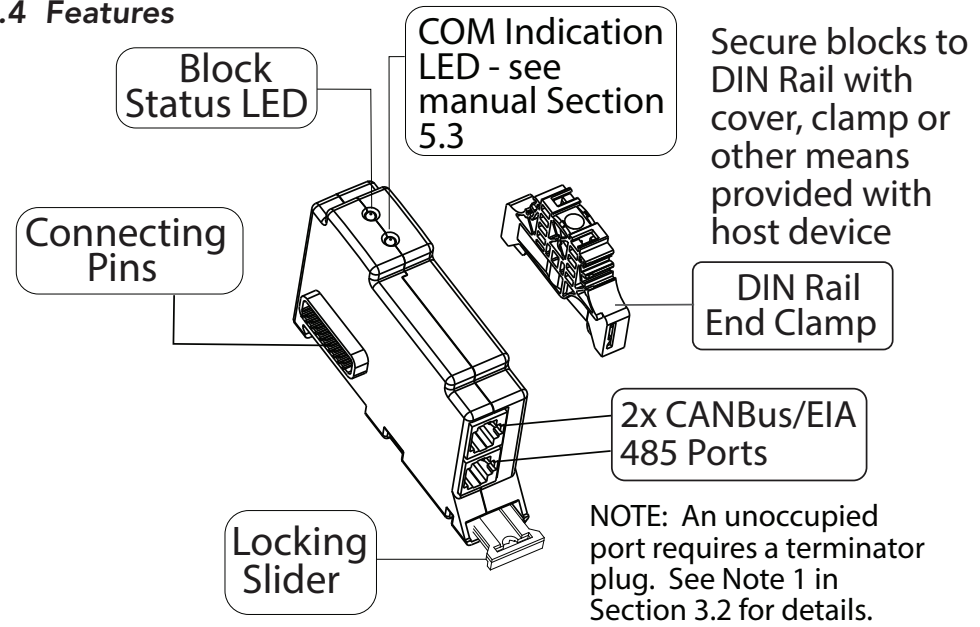


Figure 2-1. ReadyBMS Features

2.5 Limitations

Only one BMS Block is supported per system. If multiple BMS Blocks are present, a system alarm will trigger and a local display or LiveView webpage status message will indicate which of the BMS Blocks is active for collecting data from a BMS.

FURTHER:

- When using a BMS Block, only a single battery (or a bank of parallel batteries) is supported in a network of host controllers. A parallel bank is viewed by BMS as one battery.
- When using a BMS Block, only a single manufacturer of batteries is supported. If the battery/bank is changed to a new manufacturer, the host device-BMS Block needs to be re-commissioned.
- When using a BMS Block, only a single battery model is supported. If a network of parallel batteries is employed, to work properly with the BMS Block, all of the batteries must be the same model.

3.0 INSTALLATION

Morningstar Ready Blocks (ReadyShunt, ReadyRelay, ReadyBMS) are DIN rail-mounted, and have modular 20-pin connectors on each side of the Block. The left-side male connector mates with the host device's control board, while the right-side female connector is available to mate to another ReadyBlock (daisy-chain configuration - see Figure 3-1 below). Each ReadyBlock takes one of (3) positions on the GenStar DIN Rail - the left-most being Position 1.



WARNING: Shock Hazard

Disconnect all power sources to the host and all other connected devices before installing the ReadyBMS. Do not install or remove a ReadyShunt while the host device is powered ON.



NOTE: *Only one BMS Block can be active in a system at one time. If more than one BMS Block is installed, the one in the lower slot number is activated, and the other(s) are deactivated.*

3.1 Mounting

The ReadyBMS is a modular accessory designed for installation onto a DIN rail. Though there are spaces for three (3) Ready Blocks on a GenStar host device DIN rail, only one (1) ReadyBMS can be used per system.

To install a ReadyBMS (see Figure 3-1 below):

- 1) Power OFF host device. If applicable, remove Block cover and cut slot(s) for Block(s)
- 2) Pull yellow tab out
- 3) Fit Block slot downward onto DIN Rail
- 4) Slide the Block to the left, **but before** joining the male and female mates, be sure that pin guards and pins are lined up correctly. **Carefully** slide the Block farther to the left to securely join the Block pins with host-device female mates.
- 5) Push yellow tab in, to secure Block on rail
- 6) Secure Block(s) to DIN Rail with cover, clamp, or other means provided with host device.

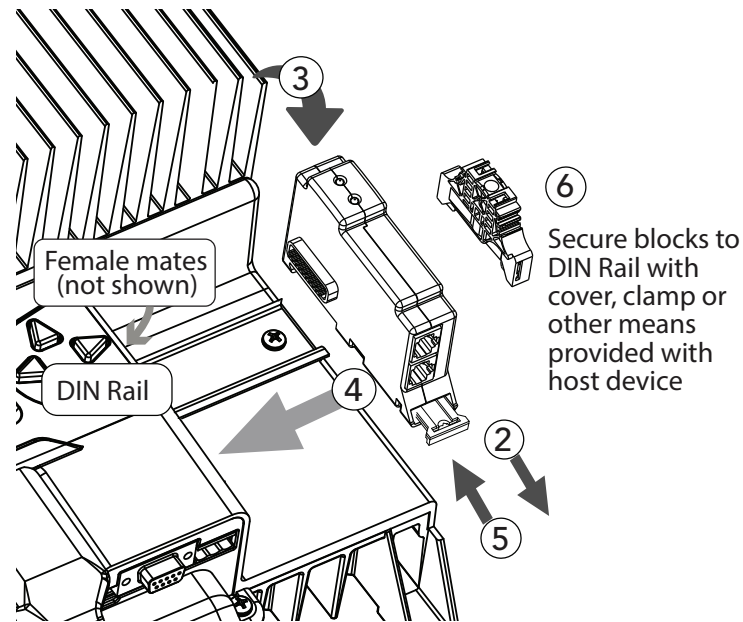




Figure 3-1. Mounting BMS Block on the Host Device

3.2 Connections

For CANBus-enabled batteries, use an 8-conductor straight-through RJ-45 cable (provided), and attach one end to one of the RJ-45 ports on the BMS Block - see Figure 2-1. Attach the other end to a CANBus port on the BMS-battery. All supported batteries conform to CAN pin configuration - for details, see Table 3-1 and Figure 3-2 in Section 3.3.

 **NOTE 1:** *If the BMS Block is used with the only controller in the system, or it is at the end of a CANBus Network, the BMS Block CANBus-RJ-45 port not connected to the BMS-battery will require installation of a terminator plug (120 Ohm terminator resistor installed across the CANL and CANH wires). A BMS Block communications terminator plug is included - see Figure 2-1 in Features Section 2.4. For any BMS-battery side CANBus termination requirement, refer to your third-party BMS-battery manufacturer's documentation.*

 **NOTE 2:** *For parallel battery configurations, refer to the BMS-battery manufacturer's documentation on how to connect the battery bank to the BMS Block.*

3.3 CANBus-enabled Batteries

All *currently* supported batteries conform to CAN pin configuration. For an up to date list of battery storage products supported by the ReadyBMS, go to www.morningstarcorp.com. CANBus-enabled batteries will require a cable assembly with the configuration seen in the Table 3-1 and Figure 3-2 below. Some BMS-battery systems may require a modified cable assembly - available separately.

Table 3-1. CANBus Protocol Battery Cabling Pin-out

BMS Block Pin	Connected to Battery BMS Pin
1	No Connect
2 GND	2
3	No Connect
4 CANH	4
5 CANL	5
6 GND	No Connect
7 RS485+	No Connect
8 RS485-	No Connect

4.0 CONFIGURATION

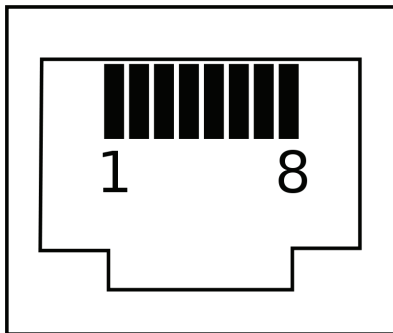


Figure 3-2. End of RJ-45 Plug - Conductor Profile

4.1 General

- **First connect the battery to the host device to power the host device-BMS system.**
- The BMS Block is configured via the local meter display during commissioning of the host device, e.g., GenStar MPPT.
Commission the host device with a compatible BMS-battery system assignment. This is the only required configuration setting; but a BMS LVD-LVR Profile can also be configured during commissioning.
- The BMS Block will automatically receive and configure all external BMS-battery charging parameters.

4.2 Configuration Access-Changes

After commissioning, access and changes to MS battery type must be done on the local meter display with a factory reset (re-commissioning).

Navigate to:

Commands\System\Reset to Factory Settings

4.3 LiveView Webpage

BMS Block DIN rail position and status can be viewed in the Morningstar LiveView Webpage - liveView Screen. Use one of the following methods to access LiveView:

With the host device connected to a PC, open a Web browser, and either:

- A) Enter the host device IP address into the address bar, e.g.,
<http://192.168.1.253>.

The IP address can be found in the meter display in Settings\Network.

OR,

- B) Enter the host device NetBIOS name [product abbreviation + 8-digit serial no.] into the address bar, e.g., <http://GS21320850>. The NetBIOS name can be found in the meter display in Settings\Network.

5.0 OPERATION

5.1 Mode of Operation

The BMS Block operates only in a Normal Mode that decodes data from a battery's BMS interface and conveys it to the host device.

5.2 Web Monitoring Support - LiveView

LiveView is the default Web Page that displays basic real-time system data, faults and alarms. See Section 4.3 for details.

5.3 LED Indications

See Figure 2-1 in Features Section 2.4, and Table 5-1 below.

Two (3)-color LEDs indicate all conditions of the ReadyBMS.

Upper LED - Status; Lower LED - COM	Indication
Interface fully-configured and active connection to battery	Lower LED blinking green
Interface fully-configured but no connection to battery - controller will be faulted	Lower LED blinking red
Interface configured, but information not yet available to controller - controller will be faulted	Lower LED blinking yellow
Bootup Error - failed data check	Both LEDs solid yellow
Bootload Error - error encountered while attempting to bootload	Both LEDs solid red
BMS Block is in the process of bootloading	Upper and lower LEDs alternate red at 4Hz

Table 5-1. LED Indications

5.4 Data Variables - Viewable in local display (if present) and LiveView status directories - refer to host device documentation for product ratings.

The BMS Block receives and uses all BMS-transmitted data for charging operations. Any variable known by the BMS can be transmitted to the BMS Block for monitoring-reporting. Beyond the brief descriptions provided, refer to BMS-battery manufacturer guidance on the meaning and significance of the following variables:

Battery Charge (V) - Battery Requested Charge Voltage

DC Charge Current Limit (A) - Battery Requested Charge Current

DC Discharge Current Limit (A) - Requested Maximum Discharge Current

Battery Discharge (LVD) (V) - Voltage Discharge Limit

Battery Nominal Capacity (A-h) - Nominal Battery Capacity

Battery Remaining Capacity (A-h) - Remaining Battery Capacity

SOC% - BMS-measured State of Charge (SOC) value

SoH% - BMS-measured State of Health (SoH) value

Battery Voltage - Actual BMS-measured battery voltage

Battery Current (A) - Actual BMS-measured battery current

Battery Temperature (°C) - Actual BMS-measured battery temperature

General Alarm - alarm indicated general battery sub-system problems not described in another alarm

Alarm: Battery High Voltage - alarm indicating the battery is above acceptable voltage

Alarm: Battery Low Voltage - alarm indicating the battery is below acceptable voltage

Alarm: Battery High Temperature (Discharge) - alarm indicating that battery is above rated temperature

Alarm: Battery Low Temperature (Discharge) - alarm indicating that battery is below rated temperature

Alarm: Battery High Charging Temperature - alarm indicating the battery is above the rated charging temperature

Alarm: Battery Low Charging Temperature - alarm indicating the battery is below the rated charging temperature

Alarm: High Current (Discharge) - alarm indicating that discharge current is above the discharge rating

Alarm: High Charging Current - alarm indicating the charging current is above the charging rating

Alarm: Contactor - alarm indicating a problem with the contactor

Alarm: Short Circuit - alarm indicating a short circuit

Alarm: BMS - alarm indicating a problem with the BMS itself

Alarm: Cell Imbalance - warning indicating an imbalance among the cells (or modules)

General Warning - warning indicating general battery sub-system problems not described in another alarm

Warning: Battery High Voltage - warning indicating the battery is at a higher than acceptable voltage

Warning: Battery Low Voltage - warning indicating the battery is at a lower than acceptable voltage

Warning: Battery High Temperature (Discharge) - warning indicating the battery is above its rated temperature

Warning: Battery Low Temperature (Discharge) - warning indicating the battery is below its rated temperature

Warning: Battery High Charging Temperature - warning indicating the battery is above its rated charging temperature

Warning: Battery Low Charging Temperature - warning indicating the battery is below its rated charging temperature

Warning: High Current (Discharge) - warning indicating that discharge current is above the discharge rating

Warning: High Charging Current - warning indicating the charging current is above the charging rating

Warning: Contactor - warning indicating a problem with the contactor

Warning: Short Circuit - warning indicating a short-circuit

Warning: BMS - warning indicating a problem with the BMS itself

Warning: Cell Imbalance - Warning indicating an imbalance among the cells (or modules)

5.5 Host Device Faults - also see Section 6.1 Faults and Corrections

If a BMS Block is required per host configuration, the following host device faults will be triggered, and will cause the host device to cease operation:

- **BMS Block Removed** - if the host is configured to use a battery that requires BMS communication, and a BMS Block is not connected to the Ready Rail (BlockBus), this fault will be present until a BMS Block is connected.
- **BMS Lost Communication** - if for any reason a BMS Block is present, and communication with a battery is lost, this fault will be present until communication is re-established.

BMS faults will appear in the host device general faults and alarms directories of the local display and LiveView web page.

5.6 Firmware Updates

A BMS Block connected to the host device will automatically have its firmware updated with the host's BMS Block firmware version. For the latest battery support and features, ensure that the host device has been updated with the most current host device product firmware.

6.0 TROUBLESHOOTING

6.1 Faults and Corrections

Table 6-1 below shows the host device-ReadyBMS fault conditions:

BMS Block removed	Solid red
BMS Block has lost communication with battery	Solid red
Internal fault condition	Solid red

Table 6-1. Host Device Fault Conditions and Status LED Indications

Problem:

BMS Block removed

Solution:

Power down the host device, install BMS Block, re-power host device

Problem:

BMS Block has lost communication with BMS-battery

Solutions:

- 1) Power down the host device, check communication cable connections, remove and firmly reconnect BMS Block to host device, re-power host device
- 2) Contact BMS-battery dealer for assistance

Problem:

Internal fault condition

Solutions:

- 1) Power down the host device, then disconnect and reconnect any required cables to the BMS block. Re-power the host device.
- 2) Power down the host device, then disconnect any cables attached to the BMS Block. Remove and replace the BMS Block, then reconnect any required cables. Re-power the host device.

7.0 WARRANTY

LIMITED WARRANTY - Morningstar Solar Controllers and Inverters

All Morningstar *Professional Series*[™] products, except the SureSine[™] inverter, are warranted to be free from defects in materials and workmanship for a period of FIVE (5) years from the date of shipment to the original end user. Warranty on replaced units, or field-replaced components, will be limited only to the duration of the original product coverage.

Morningstar *Essentials Series*[™], and SureSine[™] inverter, products are warranted to be free from defects in materials and workmanship for a period of TWO (2) years from the date of shipment to the original end user. Warranty on replaced units, or field-replaced components, will be limited only to the duration of the original product coverage.

Morningstar will, at its option, repair or replace any such defective units.

WARRANTY EXCLUSIONS AND LIMITATIONS

This warranty does not apply under the following conditions:

- Damage by accident, negligence, abuse or improper use

- PV or load currents exceeding the ratings of the product
- Unauthorized product modification or attempted repair
- Damage occurring during shipment
- Damage resulting from acts of nature such as lightning, weather extremes or infestation

THE WARRANTY AND REMEDIES SET FORTH ABOVE ARE EXCLUSIVE AND IN LIEU OF ALL OTHERS, EXPRESS OR IMPLIED. MORNINGSTAR SPECIFICALLY DISCLAIMS ANY AND ALL IMPLIED WARRANTIES, INCLUDING, WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. NO MORNINGSTAR DISTRIBUTOR, AGENT OR EMPLOYEE IS AUTHORIZED TO MAKE ANY MODIFICATION OR EXTENSION TO THIS WARRANTY.

MORNINGSTAR IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DOWN-TIME, GOODWILL OR DAMAGE TO EQUIPMENT OR PROPERTY.

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8.0 TECHNICAL SPECIFICATIONS

Electrical:

DC supply voltage source	Host Device
Self-consumption:	< 1.1 W
COM Interface Isolation Rating	1500V _{rms}

Data & Communications:

Communications Interfaces	CANBus; EIA-485
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Mechanical:

Case	Plastic
Terminations / Connectors	2x (RJ-45)
DIN-rail mount - Standard	35mm
Enclosure Rating	IP 20; Type 1; Indoor
Weight:	~2 Ounces (60 Grams)

Environmental:

Operating Temperature Range	-40°C to +60°C
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Storage Temperature	-40°C to +80°C
Altitude	3000 Meters
Humidity	100% non-condensing

Protections:

An Ethernet device can be inadvertently attached to either RJ-45 port on the BMS Block without causing damage to either the BMS Block or the attached Ethernet device. This includes connections which have Power over Ethernet (PoE) present.

CANBus and RS485 interfaces are optically isolated from the microcontroller and BlockBus.

External connector short circuit protection for adjacent pins

Cable pinout miswire

9.0 CERTIFICATIONS



FOR CURRENT DETAILED CERTIFICATION LISTINGS, REFER TO:

<https://www.morningstarcorp.com/support/library>

Under, "Type", choose, "Declaration of Conformity (DOC)", to view list of product DOCs.

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NOTES: